The influence of Hoki fishing vessels on Westland Petrel (*Procellaria westlandica*) distribution at sea

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ABSTRACT

The Westland Petrel (*Procellaria westlandica*) population is thought to have increased significantly in recent decades, perhaps as a result of increased food in the form of waste from fishing vessels. A survey of Westland Petrels off the West Coast of the South Island, New Zealand, showed that fishing vessels in the West Coast South Island Hoki (*Macruronus novaezelandiae*) fishery influence the distribution of Westland Petrels, but only a small proportion of the Westland Petrel population appears to utilise this fishery waste at any one time. Westland Petrels appear to select foraging areas primarily on natural features, such as water depth, and only if fishing vessels are in the same area are Westland Petrels attracted to them.

KEYWORDS: Westland Petrel, *Procellaria westlandica*, Hoki, *Macruronus novaezelandiae*, fishery waste.

INTRODUCTION

The Westland Petrel (*Procellaria westlandica*) is a large burrowing petrel which breeds only near Punakaiki on the West Coast of the South Island of New Zealand (42° S, 171° E). The Westland Petrel population is thought to have increased significantly in recent decades. In the late 1980s, the total population was estimated at 20 000 (Marchant & Higgins 1990); a large increase on the 1972 estimate of 6 000-10 000 (Bartle 1974). It has been suggested that this population growth is a result of increased food in the form of waste from fishing vessels which is now assumed to be an important component of their diet (Bartle 1985, 1987).

In the late 1950s few Westland Petrels fed on trawl waste from fishing vessels (Bartle 1974). However, the number feeding on the Cook Strait trawling grounds greatly increased during the 1960s (Bartle 1974). In October/November 1975 Westland Petrels were observed feeding on discarded fish offal during exploratory fishing off Greymouth, West Coast (Vooren 1977). This behaviour is considered common today as Westland Petrels are frequently seen feeding on waste from West Coast Hoki (*Macruronus novaezelandiae*) trawlers and from other fishing vessels within their range (Marchant & Higgins 1990).

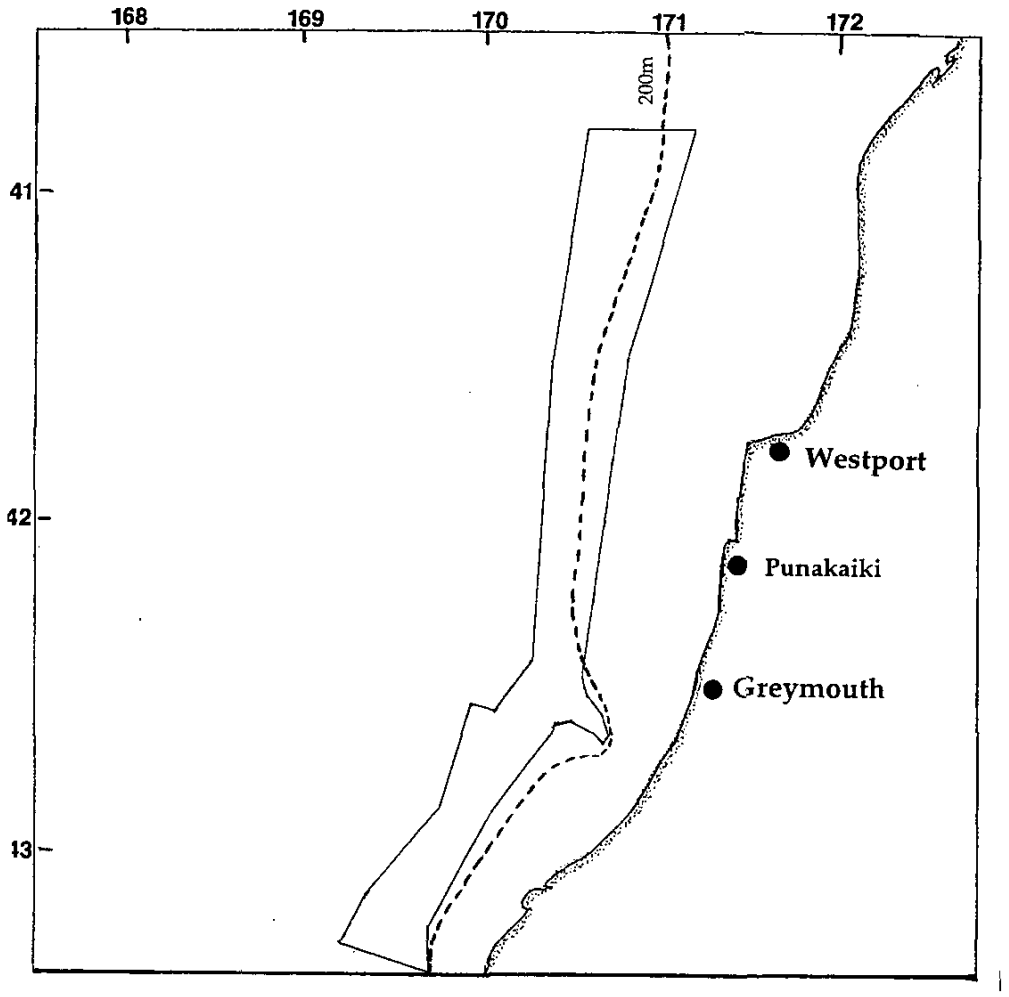

FIGURE 1. – Acoustic survey area, West Coast, South Island 2-14 August 1993 (based on Voyage Programme TAN 93/07, P.L. Cordue, MAF Fisheries).

The West Coast Hoki fishery is by far the largest of the commercial fishing operations close to the Westland Petrel's breeding colonies. The fishery operates from mid June to early September when Westland Petrels are incubating eggs and raising chicks. The Hoki fishery is New Zealand's largest commercial fishery in terms of total catch. In 1977, catches reached almost 98 000 t, peaked at about 220 000 t in 1988 but have since declined to around 100 000 t per year on the West Coast (Sullivan & Cordue 1992; S. Ballara pers. comm.). Livingston & Rutherford (1988) estimated that during the 1986 fishing season, 37% of the West Coast catch was dumped as waste. Therefore, about 37 000 t may now be discharged annually from the West Coast fishery, although the quantity will vary depending on the composition and characteristics of the fishing fleet from year to year. For example, Livingston and Rutherford (1988) estimated that in the 1985-1986 fishing year, 48% of the catch from surimi vessels was dumped as waste compared to only 25% of the catch from non-surimi vessels.

It is difficult to demonstrate clear links between seabird population changes and fisheries. It is clear, however, that for some species, fisheries waste now forms

a significant part of their diet. For example, Jackson (1988) found that trawler offal was the dominant food by mass of White-chinned Petrels (*Procellaria aequinoctialis*) in the southern Benguela region of South Africa. It has been suggested that if a large enough proportion of a species' population comes to depend on scavenging at fishing vessels, there is potential for modification of that species' foraging behaviour, diet and survival (Abrams 1983). In such a species, a change in the level of fishing activity could affect that species' population size. The importance of fisheries waste in the diet of Westland Petrels needs to be assessed because fisheries waste on the West Coast may be reduced through the withdrawal of many surimi vessels in favour of smaller filleting vessels and due to an increasing proportion of the Hoki quota being caught in Cook Strait and other areas.

The importance of fishing vessels as a source of food can be inferred by comparing the distribution of a species at sea with that of fishing vessels. Ryan & Moloney (1988) for example, compared the dispersion of seabirds and seals to that of trawling effort in the southern Benguela demersal trawl-fishery and found that the distribution of some species, including the White-chinned Petrel, was significantly influenced by commercial trawling activity. The influence of fishing vessels in the West Coast Hoki fishery on the distribution of Westland Petrels was investigated during a seabird survey conducted during August 1993. The survey formed part of a larger study on Westland Petrel diet and foraging ecology.

METHODS

From 2 - 14 August 1993, the Ministry of Agriculture and Fisheries (MAF Fisheries) research vessel *Tangaroa* conducted acoustic surveys of spawning Hoki off the West Coast of the South Island (Fig. 1). The survey included the areas intensively worked by Hoki trawlers and coincided with the early chick rearing period when Westland Petrels may be most likely to take advantage of the nearby fishery. The *Tangaroa* was not fishing during this period, except for nine short trawls to validate acoustic data. These trawls were mainly at the end of the day and so did not affect the counts of birds, which were completed earlier in the day. Therefore, it is assumed that the "attraction" of the *Tangaroa* to birds was constant throughout the voyage.

Ten-minute counts of seabirds, visible with 8x40 binoculars all around the vessel (360°) to a distance of 500 m, were made every half hour during daylight hours. All birds were recorded but only Westland Petrels and unidentified, black *Procellaria* are reported here. Records of Westland Petrels and unidentified *Procellaria* were extracted from the counts made over the edge of the continental shelf and inner continental slope (waters 200 to 800 m deep) where Westland Petrels generally forage (n=124 counts). Although 46% (38 birds) of all *Procellaria* sightings were unidentified, these were combined with the positively identifed Westland Petrel records. The unidentified *Procellaria* could have been White-chinned Petrels (*Procellaria aequinoctialis*). However, as this species is less abundant in the Tasman Sea than to the south and east of New Zealand (Imber 1985), generally forages further out to sea than Westland Petrels and was positively identified only once during the survey, it is most likely that the unidentified *Procellaria* recorded

were *westlandica.* Counts carried out while the *Tangaroa* was trawling or discharging waste were not included in this analysis.

Immediately before each count, the distance between the *Tangaroa* and other vessels was recorded from the ship's radar and where possible the types of vessels recorded. These data supplemented the trawl data used in the Geographical Information System (GIS) analysis described below, particularly for small vessels for which no locality data were available.

Positions of large (>43 m) vessel trawls in the West Coast South Island fishing area were provided by MAF Fisheries. During the period of the survey there were 1804 trawls set by 55 large vessels in this area. Each day's trawls were entered into the GIS ARC/INFO (Environmental Systems Research Institute Inc. 1991). The number of small (<43 m) vessel trawls in West Coast fishing areas were also provided by MAF Fisheries, but their positions were not known as small vessels are not required to record that information.

The minimum distance between the *Tangaroa's* position at the start of each count and the position of any large vessel trawl on that day was calculated by ARC/INFO. The mean number of Westland Petrels and unidentified *Procellaria* observed during counts in which no vessels were nearby was compared using two-sample Mann-Whitney tests with the mean number observed when at least one vessel was within 5, 10, 15 and 20 km respectively. If one or more small vessels had been recorded close by during a count, that was also included in this analysis. Closeness to at least one vessel generally indicated proximity to the Hoki fishing fleet as a whole because vessels were typically clumped (pers. obs.). If Westland Petrel distribution is independent of the distribution of fishing vessels, then the mean number observed close to fishing vessels should not differ significantly from the mean number encountered away from fishing vessels.

RESULTS

During the survey, Westland Petrels and unidentified *Procellaria* were recorded only over shelf edge and inner slope waters (250-780 m). Although ten counts were made in shallower water (100-200 m), and eight of these were near to fishing vessels, no Westland Petrels or unidentified *Procellaria* were observed there. Neither were any observed during the nine counts made in deeper water (800 -1500 m).

Within the 200-800m depth range the mean number of Westland Petrels and unidentified *Procellaria* observed within 20km of the nearest fishing vessel (mean = 0.8 / 10-min count) was significantly higher than the mean number observed further than 20km from fishing vessels (mean = 0.4 / 10-min count) (n=124 counts, P = 0.03). There were no significant differences between the numbers of Westland Petrels and unidentified *Procellaria* observed within five, ten and 15km of fishing vessels and the numbers observed further away. Only 82 Westland Petrels and unidentified *Procellaria* were recorded during the counts.

DISCUSSION

If waste from fishing vessels is an important component of the diet of Westland Petrels, the distribution of fishing vessels could be expected to influence the distribution of Westland Petrels at sea. In the present study there were no significant differences between the numbers of Westland Petrels and unidentified *Procellaria* observed within five, ten and 15 km of fishing vessels and the numbers observed further away. It was not until numbers more than 20 km away from fishing vessels were considered that a significant difference was found. This is not surprising considering that the concentration of vessels in the Hoki fleet could be expected to influence bird distributions over the entire fleet area as birds commute between vessels. This distance corresponds to the 15-20 km range over which Westland Petrels, soaring about 5-10 m above the sea surface, could detect flocks of birds feeding behind vessels (Haney *et al.* 1992). These results indicate that vessels in the West Coast Hoki fishing fleet were attracting Westland Petrels, increasing their numbers within a radius of 20 km from the vessels.

Other environmental factors besides fisheries certainly influence the distribution of Westland Petrels off the West Coast of the South Island. It is known that Westland Petrels are continental shelf edge and inner slope feeders (Marchant & Higgins 1990) and the depth range over which Westland Petrels were observed during this survey (250-780 m) supports this. Westland Petrels were not observed near fishing vessels in shallower water (100-200 m), nor were any Westland Petrels seen over deeper waters. This suggests that Westland Petrels select foraging areas primarily on natural features, such as water depth, and only if fishing vessels are in the same area are Westland Petrels attracted to them.

While Westland Petrels and unidentified *Procellaria* were more numerous within 20 km of fishing vessels than further away from fishing vessels, the total number recorded was low considering the proximity of the survey to the species' breeding colony (Fig. 1). It is unlikely that there were many birds feeding out of view close behind fishing vessels because the *Tangaroa* passed alongside processing vessels on several occasions during the survey and feeding flocks behind these vessels were closely observed (although they were not always included in the 10-min counts). A maximum of 16 Westland Petrels was seen around any one fishing vessel.

This suggestion that the number of Westland Petrels scavenging around Hoki fishing vessels at any one time is low is supported by counts made from the air on 6 August 1995 when only 217 *Procellaria* were seen around the entire Hoki fleet (J. A. Bartle & J-C. Stahl pers. comm.). Likewise, although up to 150 Westland Petrels were observed from a vessel trawling and discharging offal on the West Coast Hoki grounds in August and September 1994, numbers were generally much lower (average of 27 from eight 10-min counts) (P. Langlands pers. comm.). The same pattern seems to occur earlier in the breeding season. For example, Langlands (1989) recorded only about five Westland Petrels each time the net was hauled behind a fishing vessel off south Westland during June-July 1988. He also recorded only small numbers (maximum 11) scavenging behind a boat on the Challenger Plateau in June-July 1994 (P.Langlands pers. comm.). In contrast, Vooren (1977)

saw large numbers of Westland Petrels, usually about 500, aggregating at a vessel off Greymouth in October/November 1975. This could have been because more adults were feeding on waste prior to migrating.

These results show that fishing vessels do influence the distribution of Westland Petrels at sea. At least during some of the breeding season, however, it appears that at any one time only a small proportion of the Westland Petrel population is utilising the fisheries waste resource. It was not clear from this study whether only a small proportion of the population ever scavenges behind vessels, or whether a larger number are involved, but only for short periods. Other components of this research, diet studies and satellite tracking (A.N.D. Freeman unpubl. data.), suggest that the latter scenario is more likely.

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